(12) UK Patent Application (19) GB (11) 2 206 099 (13) A

(43) Application published 29 Dec 1988

(21) Application No 8811301

(22) Date of filing 12 May 1988

(30) Priority data
(31) 8706704 (32) 13 May 1987 (33) FR

(51) INT CL⁴
G01F 11/32 B65D 83/14

(52) Domestic classification (Edition J):
B8N 503 KB

(56) Documents cited
None

(58) Field of search
B8N
Selected US specifications from IPC sub-classes
G01F B65D

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(54) A metering valve for a liquid charged with a propellent liquid of liquified gas and usable in the upsidedown position

(57) When the valve is turned upsidedown, the metering chamber (16) is filled with liquid via a gap (2a) between a gasket (2) and the valve rod (9). In order to fill the chamber as quickly as possible, the gas leaving the chamber must be prevented from opposing the inward flow of liquid. To do this, the gas is evacuated via a central channel (21) in the valve rod; as liquid passes down via opening (8) and around a thinner portion (14) of valve rod (9) via annular gap (2a), gas exits via radial passages (21b), passage (21) and opening (21a) to escape via orifice (1b).

Fig. 1

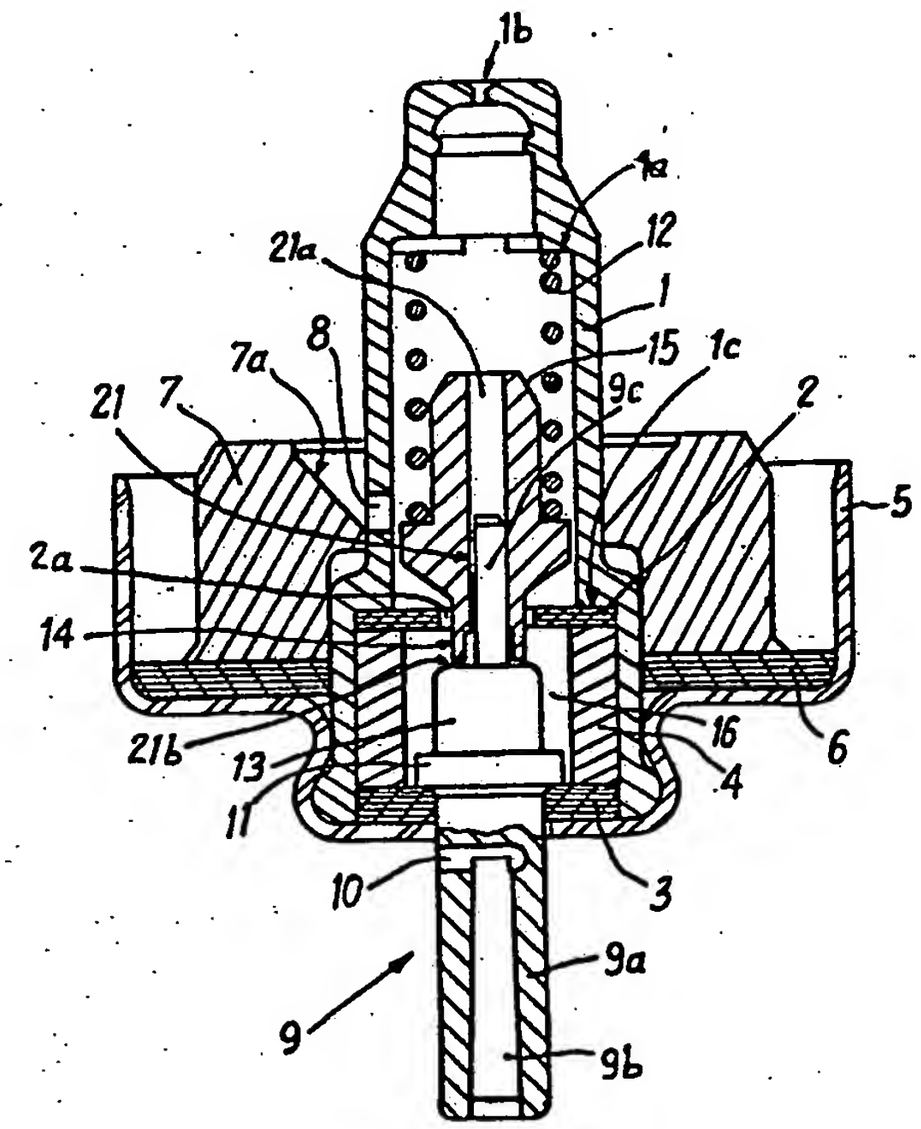

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Fig. 1

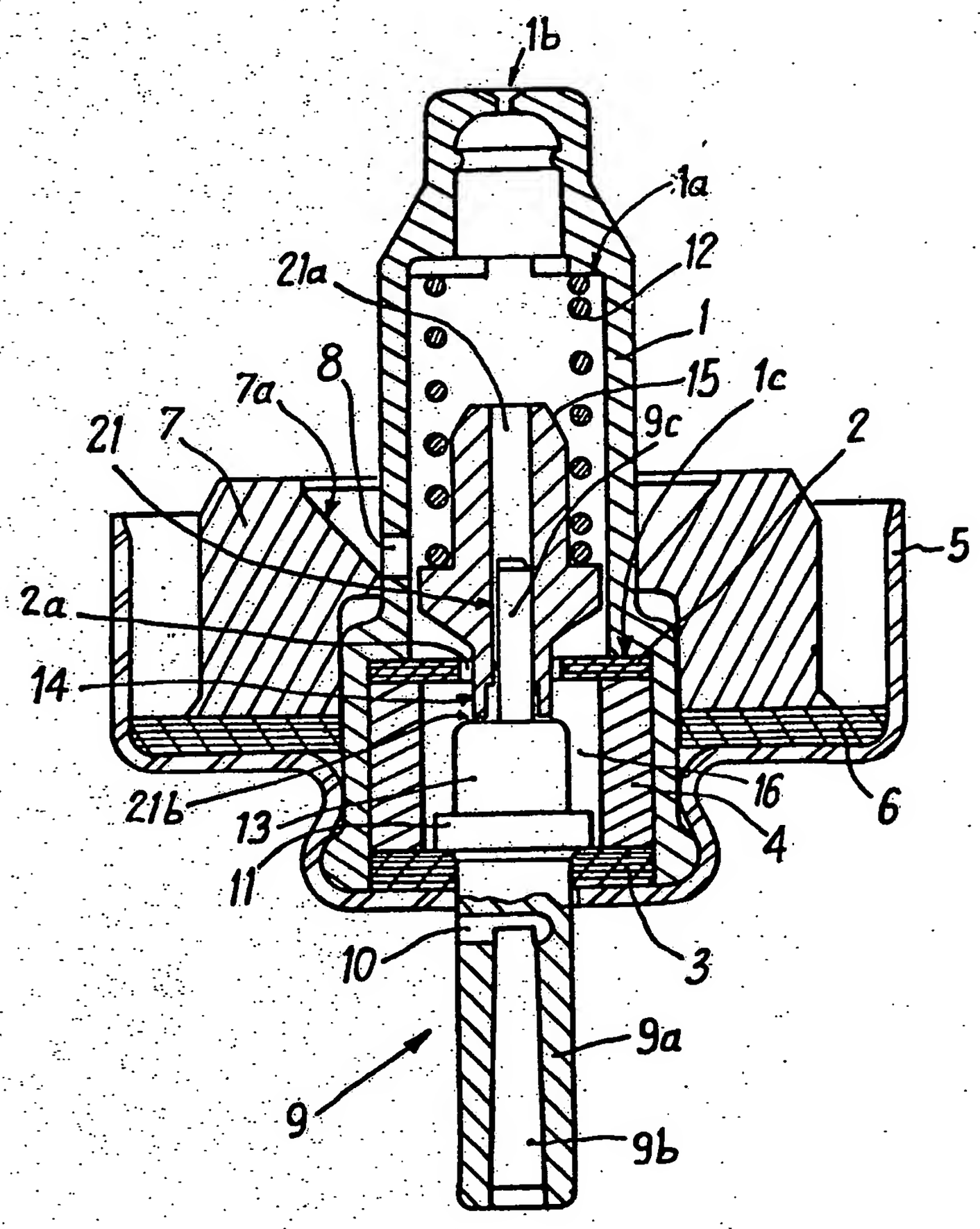


Fig: 2

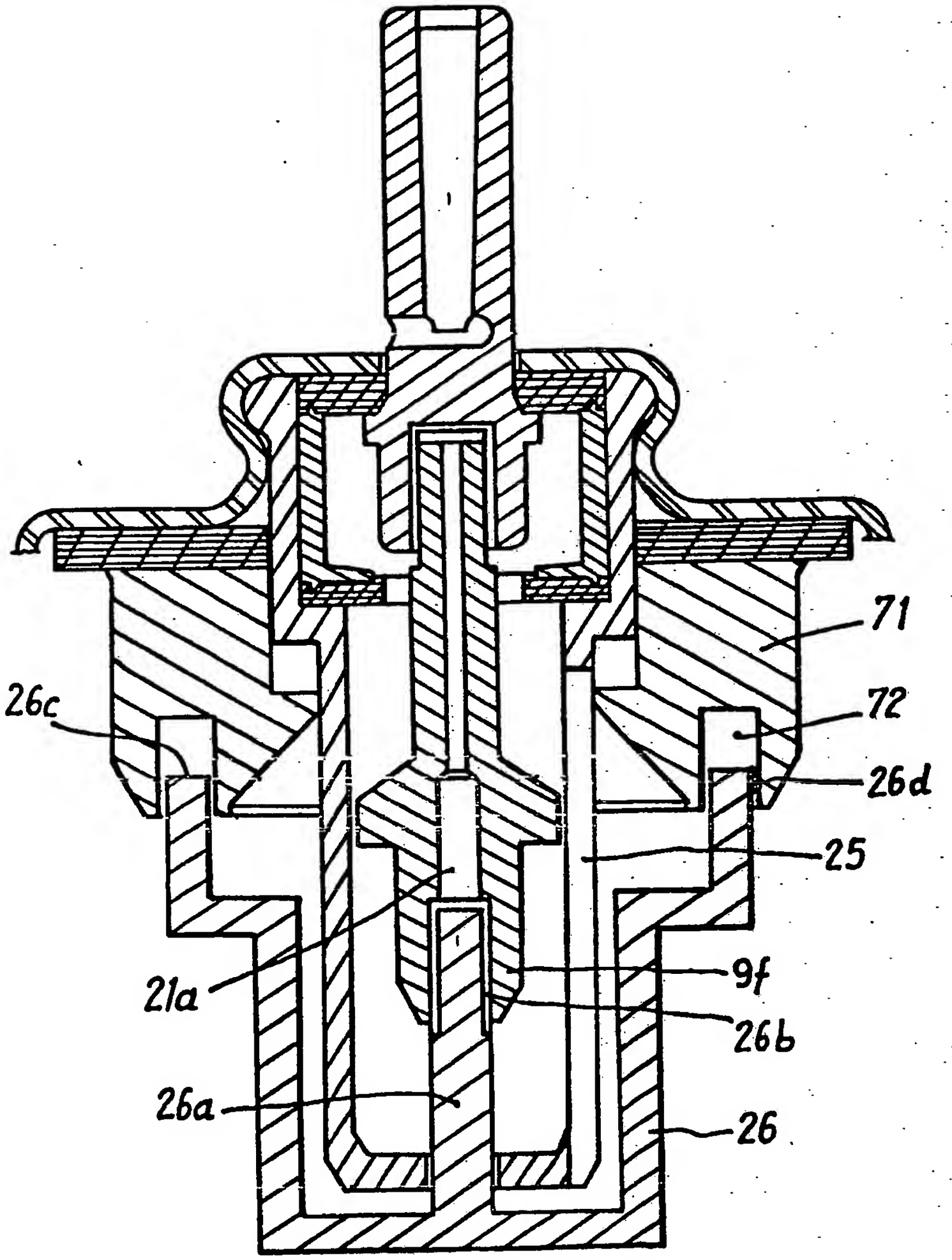
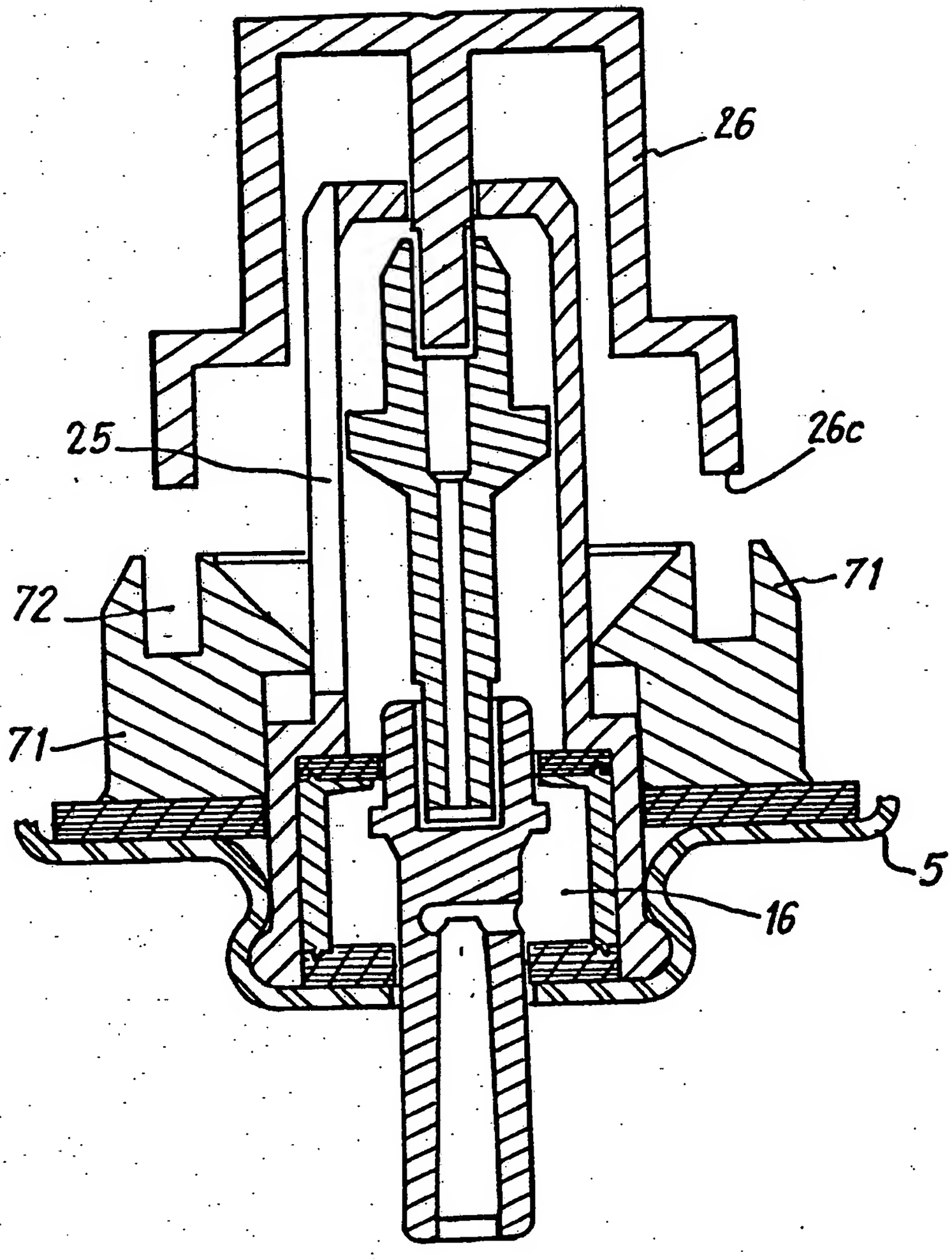


Fig. 3



A METERING VALVE FOR A LIQUID CHARGED WITH A PROPELLENT LIQUID OR LIQUIFIED GAS AND USABLE IN THE UPSIDEDOWN POSITION

The present invention relates to valves for a liquid charged with a propellent liquid or liquified gas and intended to be mounted in the openings of aerosol cans which are usable in the upsidedown position. A valve of this type is described in French patent number 1 225 163, inter alia, and comprises: a valve body open at two ends and containing a metering chamber which is axially delimited by two washer-shaped gaskets, namely a valve gasket and a chamber gasket; and a valve rod passing through the gaskets and movable inside the valve body between a rest state and an actuated state. The valve rod including a shoulder which, in the rest state of the valve is maintained pressed against one of the gaskets by a spring which bears firstly against a shoulder of the valve body and secondly against a shoulder of the valve rod. The outside end of the valve rod includes an axial blind channel which opens out to its outside surface via a radial hole situated at a location such that said hole opens out to the outside of the valve gasket when the valve is in the rest state and to the inside of the valve chamber when the valve rod is pressed into its actuated state, the outside surface of the valve rod being shaped in such a manner that when in the rest state, the metering chamber is capable of being filled by the liquid contained in the can, and when in the actuated state, communication with the can is interrupted such that the chamber empties via the axial channel of the valve rod under the effect of the propellent gas. When such an aerosol device is not in use, the can is normally stood on its bottom. Naturally, this causes the metering chamber which is then at the top of the can close to the can outlet duct to tend to empty, in particular if the metering chamber is of the type which is open in the rest state. When the user next takes the can in the upright position and then turns it upsidedown and actuates the valve at once, there is a danger of an incomplete metered quantity of liquid being expelled, assuming that the metering chamber has emptied partially and that the can is not held upsidedown prior

to valve actuation for long enough to ensure that the metering chamber is completely refilled. Further, if after use, the user turns the can the rightway up prior to releasing the pushbutton, then the metering chamber will generally fill with gas, and the next time the can is used, this too will cause an incomplete metered quantity of liquid to be ejected unless the chamber is given time to refill completely prior to actuating the valve.

Preferred embodiments of the present invention provide a metering valve which is usable in the upsidedown position with a liquid charged with a propellent, and ensure that in all operating circumstances a full metered quantity of liquid is expelled. Since the metering valve is of the type having a metering chamber which is open in the rest state, the invention seeks to provide substantially instantaneous rapid filling of the metering chamber as soon as the can is turned upsidedown, and prior to the user depressing the pushbutton for expelling the contents of the metering chamber. In the course of study and experimentation, the Applicant has had the idea that metering chamber filling would be facilitated and accelerated if special means were provided for removing any gas which may be contained in the metering chamber via a path which is different from that which is taken by the liquid in order to reach said metering chamber for the purpose of filling it, such that the flow of gas leaving the chamber does not oppose the flow of liquid entering the chamber.

The present invention provides a valve body which is open at two ends and which contains a metering chamber which is axially delimited by two washer-shaped gaskets, namely a valve gasket and a chamber gasket, and a valve rod passing through the gaskets and movable inside the valve body between a rest state and an actuated state, the valve rod including a shoulder which, in the rest state of the valve, is held pressed against the valve gasket by a spring bearing firstly against the bottom of the valve body and secondly against the inside end of the valve rod, the valve rod including, adjacent to the shoulder, a plug extended by a thinner portion which passes through the

hole in the chamber gasket when the valve is in the rest state, thereby leaving a gap between the thinner portion and the inside edge of the hole in the gasket, the plug being of such a size that it closes the hole in the chamber gasket when the valve rod is depressed to its actuated state from its rest state towards the inside of the valve body against the force of the spring, the outside end of the valve rod including an axial channel opening out via a radial hole to its outside surface, said hole being situated at such a level that the hole opens to the outside of the valve gasket when the valve is in the rest state and to the inside of the metering chamber when the valve rod is pressed into its actuated state, wherein the thinner portion of the valve rod includes an internal channel opening out firstly in the vicinity of the inside end of the valve rod and secondly at a point adjacent to said plug which point is situated inside the metering chamber when the valve is in the rest state. In this way, when an aerosol can containing a liquid charged with a dissolved propellent gas is turned upsidedown in order to be used with the valve in the bottom position, the liquid can enter the metering chamber without encountering the gas which was previously contained therein flowing in the opposite direction through a small cross-section since the gas escapes via the inside of the valve rod.

In a variant embodiment, the inside end of the valve rod is provided with a retaining cup which opens towards the outside of the valve and which is constrained to move with the valve in such a manner that when the valve is in its rest state, the opening of the cup is closed with the cup practically completely enclosing the valve, and when the valve has moved inwardly during valve actuation, the cup is also moved inwardly, thereby opening its opening to enable the cup and the metering chamber to be filled.

Embodiments of the invention are described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an upsidedown section view of a valve in accordance with one embodiment of the invention, which valve is mounted in a capsule ready for being crimped to the neck of a can or other aerosol container;

Figure 2 is a view similar to Figure 1, but the rightway up, and showing a variant embodiment; and

Figure 3 shows the Figure 2 valve in the upsidedown operating state.

In the following description, the term "inside" designates that side of the valve which is closest to the bottom of the can, and the term "outside" designates the opposite end: it is preferable to avoid using the terms "top" and "bottom".

The valve shown in Figure 1 comprises a valve body 1 defining an inside housing having a step 1a near its inside end and an opening 1b of smaller diameter suitable for passing gas freely but for opposing or slowing down the passage of liquid. At its outside end, the housing includes a portion which delimits a metering chamber 16 between two gaskets 2 and 3. The chamber gasket 2 is placed between another step 1c of the body 1 and a tubular spacer 4 which is pressed against the gasket 2 via the valve gasket 3 by being crimped in the capsule 5, thereby also putting the valve gasket 3 under compression. The capsule 5 may be mounted on any can or flask (not shown) by being crimped thereto so as to compress a bottle-neck gasket 6. A ring 7 serves to facilitate complete emptying of the can by virtue of a tapering surface 7a co-operating in conventional manner with a body having three slots or with a filling hole 8 on the inside of the valve body. A valve 9 comprises a tubular portion 9a having a central duct 9b with a side opening 10 which is located outside the valve in the rest state when the shoulder 11 of the valve is pressed against the gasket 3 by the spring 12, which spring also presses against the step 1a. The valve is extended by a plug 13 suitable for closing the central hole of the gasket 2 when resiliently engaged in said gasket by pressing the valve inwardly by means of a pushbutton (not shown). The plug 13 is followed by a narrower portion 14 which passes through the chamber gasket 2 leaving a gap which constitutes a small or throttle cross-section 2a. The valve terminates with a portion 15 serving to guide the valve in its displacement and as an abutment for the spring 12.

In order to use the valve, it is turned upsidedown so as to occupy the position shown in Figure 1. The liquid contained in the can then flows into the valve body via the hole 8, while any gas which may be remaining in the valve body can escape via the small-sized hole 1b. After penetrating into the valve body via the hole 8, the liquid descends into the chamber 16 situated between the gaskets 2 and 3 by passing through the gap at the hole in the gasket 2 between the inside edge of the gasket and the thinner portion 14 of the valve. The operation of such valves is conventional. With the valve in the upsidedown position, as shown, any air remaining in the chamber 16 when the valve is turned upsidedown escapes from the chamber 16 via the gap 2a through which the liquid which is to replace this air is flowing in the opposite direction. These opposing motions delay complete filling of the chamber. If the user actuates the valve too quickly, there is a risk of expelling an incomplete metered quantity of liquid. This is a serious drawback. The present invention avoids it. According to the invention, any gas occupying all or a portion of the chamber 16 is evacuated from the chamber without going through the gap 2a, Instead it passes along a channel 21 provided inside the valve rod. This channel opens out firstly to the inside end of the valve at 21a, preferably above the liquid inlet hole 8, and secondly via a small radial passage 21b situated inside the chamber 16 when the chamber is open, and the valve is in its rest state, i.e. between the plug 13 and the thin portion 14.

While the chamber 16 is filling with liquid in the upsidedown position as shown in the figure, liquid arrives via the hole 8 and via the gap 2a, while gas rises to escape via the passage 21b without passing through the gap 2a. As a result two opposing fluid motions do not occur in the gap. Filling therefore takes place uniformly and quickly.

In the embodiment shown, the valve is constituted by two pieces which are assembled by being force-fitted together, in conjunction with optional welding or gluing. They are force-fitted by forcing an extension 9c of the outside portion of the valve into the central cavity 21a of its inside portion. This

extension includes grooves to leave a channel 21 while ensuring adequate wedging of the outside portion in the inside portion. Further, the inside edge of the inside portion includes one or more notches for forming radial passages 21b. Since it is very common practice to make a valve in two parts when the shape of the valve is not simple, the present invention solves a problem without increasing cost price, since performing the present invention merely requires the molds of the two parts of the valve to be modified slightly.

Figure 2 shows a variant embodiment in the rightway up position; i.e. the position in which the valve is to be found when the aerosol can is not in use and is standing on its bottom. The valve is in air and is thus the other way up. Overall, the Figure 2 valve is similar to the Figure 1 valve, and it operates in the same way. It will be observed that instead of having one or more hole(s) 8, it has one or more slot(s) 25 extending along a certain height of the valve body. It will also be observed that it is now the inside part of the valve which is forced inside the outside part. The result is equivalent. In this embodiment, a cup 26 is fixed to the end of the valve 9f, for example by fitting a rod 26a fixed to the cup inside the central channel 21a of the valve. The end of the rod 26a is provided with grooves 26b in order to provide a force-fit while leaving a free passage for gas flow. In this way, the cup 26 moves with the valve. The top rim 26c (in the Figure 2 position) of the cup is situated at a level such that when the valve is at rest it closes the cup by the rim co-operating with a ring 71. For example, the ring may include a circular groove 72 in which the rim 26c of the cup is received, together with an optional sealing ring 26d.

Any other means may be used for obtaining sealing, and the sealing is not necessarily perfect.

Figure 3 shows the valve in an in-use position, i.e. in the upsidedown position with the valve pressed in. It can be seen that the cup 26 is raised and that a broad passage subsists between the rim 26c of the cup and the ring 71, thereby enabling the liquid contained in the aerosol can to

flow abundantly and without restriction into the cup, and through the slots 25 into the valve body which is to be found therein.

Regardless of whether the user closes the valve before or after turning the can the rightway up, liquid will always remain in the cup once it has been turned back the rightway up into the Figure 2 position. This quantity of liquid will arrive immediately in the metering chamber as soon as the can is turned upsidedown for use in the position shown in Figure 3, and operating the valve will therefore ensure that a complete metered quantity is expelled.

Naturally, the present invention is not limited to the above-described examples. On the contrary, the person skilled in the art may find modifications and variants thereof.

CLAIMS

1/ A metering valve for a liquid charged with a propellent liquid or a liquified gas, the valve being for mounting in the neck opening of an aerosol can usable in the upsidedown position, the valve being of the type comprising a valve body which is open at two ends and which contains a metering chamber which is axially delimited by two washer-shaped gaskets, namely a valve gasket and a chamber gasket, and a valve rod passing through the gaskets and movable inside the valve body between a rest state and an actuated state, the valve rod including a shoulder which, in the rest state of the valve, is held pressed against the valve gasket by a spring bearing firstly against the bottom of the valve body and secondly against the inside end of the valve rod, the valve rod including, adjacent to the shoulder, a plug extended by a thinner portion which passes through the hole in the chamber gasket when the valve is in the rest state, thereby leaving a gap between the thinner portion and the inside edge of the hole in the gasket, the plug being of such a size that it closes the hole in the chamber gasket when the valve rod is depressed to its actuated state from its rest state towards the inside of the valve body against the force of the spring, the outside end of the valve rod including an axial channel opening out via a radial hole to its outside surface, said hole being situated at such a level that the hole opens to the outside of the valve gasket when the valve is in the rest state and to the inside of the metering chamber when the valve rod is pressed into its actuated state, wherein the thinner portion of the valve rod includes an internal channel opening out firstly in the vicinity of the inside end of the valve rod and secondly at a point adjacent to said plug, which point is situated inside the metering chamber when the valve is in the rest state.

2/ A metering valve according to claim 1, wherein the valve rod is formed by two parts which are fitted one in the other, with at least one part including grooves in its surface facing the other in order to form a channel, with a notch being optionally

provided at the end of one of the parts in order to form a radial passage enabling said channel to communicate with the outside of the valve rod.

3/ A metering valve according to claim 1 or 2, wherein the inside end of the valve rod is provided with a retaining cup which is open towards the outside of the valve, and which is constrained to move in conjunction therewith in such a manner that in the rest state of the valve the opening of the cup is closed, with the cup surrounding the valve, and wherein the actuated state of the valve, the cup is opened for filling purposes.

4/ A metering valve according to claim 3, wherein the valve is surrounded by a ring having a circular groove formed therein, which groove receives the rim of the cup when the valve is in its rest state.

5/ A metering valve substantially as herein described with reference to and as illustrated in Figure 1 or Figures 2 and 3 of the accompanying drawings.

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